Utah Division of Air Quality

Ambient Monitoring Protocol for the UAM-AERO Model

January 28, 2000

TABLE OF CONTENTS

A. Purpose of Collecting Ambient Monitoring Data 4

B. Study Management 4
1. Distribution list 4
2. Project organization 4
3. Time line for deliverables 4

C. Data Quality Objectives 4
1. Intended use of data in the order of importance 4
2. The users of the data and the decision makers 4
3. Amount of data needed 5
4. Criteria for using data 5
5. Summary statistics that will be used 5
6. Acceptable level of confidence in the data needed for the stated purpose 5

D. Criteria for Initiating PM10 Episode Data Collection 5
1. Assumptions 5
2. Procedure 5
3. Contact List 6

E. Ambient Monitoring 6
1. Length of study 6
2. Rationale for selecting study sites 6
3. Parameters to be measured 7
4. Sampling schedule and averaging times for each parameter (see PM study chart) 7

F. Description of Study Environment 10

G. Equipment Placement 10

H. Equipment Description 10

I. Laboratory Analysis of Samples 10

J. Quality Control Description 10

K. Quality Assurance Description 10

L. Data Chain of Custody 10

M. Final Report 11

A. Purpose of Collecting Ambient Monitoring Data

The UAM-AERO model is a grid-based photochemical model designed to identify distribution of PM10 concentrations in the Wasatch Front area for past and future episodes. The last PM10 exceedance occurred in 1996 and two episodes from that year had to be selected for the modeling exercise. Previously, the model was used for regulatory application twice in California. Both times, modeling results were rejected as the regulatory basis for SIP development. Lack of adequate meteorological and speciated PM10 data for one of the 1996 Utah episode days will make it almost impossible to verify model performance in any meaningful way. Thus, Utah has decided to temporarily expand the existing PM network during the 1999-2000 winter inversion season and also increase the frequency of data collected at certain sites in hopes of capturing a unique data-rich episode to verify model performance. The meteorological network has been expanded significantly since 1996 and except for a Doppler Acoustic Sounder, no new meteorological sites will be needed.

B. Study Management

1. Distribution list

a. DAQ: Ursula Kramer, Robert Dalley, Brock LeBaron, Dave McNeill, Rick Sprott
b. EPA: Ron Heavner, Kevin Golden

2. Project organization

Project Manager - Ursula Kramer
QA Coordinator - Rolf Doebbeling
Project Operations -Robert Dalley

3. Time line for deliverables

a. Quality assured monitoring data for model input will be available no later than March 15, 2000.

b. Quality assured speciation data will be available no later than June 1, 2000.

C. Data Quality Objectives

1. Intended use of data in the order of importance

a. Meteorological and inventory data will be used to run the model.

b. PM, PM speciated and gaseous data will be used for model performance evaluation.

2. The users of the data and the decision makers

a. The users of the data will be primarily the DAQ Technical Analysis Section.

b. Decisions made based on the data will made by EPA, DAQ upper management, Wasatch Front Regional Council and the Federal Highway Administration.

3. Amount of data needed

a. Data will be needed for two episodes with a 90% recovery for each parameter.

4. Criteria for using data

a. Data must meet accuracy, precision and completeness goals as required by federal regulations and guidelines before it can be used for model performance evaluation. If these goals are not met the use of the data will be reassessed.

5. Summary statistics that will be used

a. Summary statistics for evaluating the quality of the data will be the same as used for the regulatory monitoring network and will follow the applicable federal regulations and guidelines.

6. Acceptable level of confidence in the data needed for the stated purpose

a. All data must meet regulatory requirements established for federally enforceable monitoring networks.

b. Data in general must be accurate and precise within +/- 15 percent.

D. Criteria for Initiating PM10 Episode Data Collection

1. Assumptions

a. The Air Monitoring Center (AMC) requires two days to reconfigure the monitors to collect the PM10 data specified in the air quality action plan.

b. The desired meteorology consists of a high pressure system centered over the region for a period of five days or more.

c. University of Utah Meteorology Department's (Met Dept) extended forecasts are very uncertain beyond seven days but should be good for an early warning. A three-day forecast should be good for making a go/no-go decision.

d. In addition to the desired meteorology, the criteria for calling a PM10 episode consists of snow covered ground, high relative humidity, clearing index less than 100, and PM10 values of about 50 ug/m3.

e. The modelers are looking for a PM10 episode that shows high (but not necessarily above the standard) values lasting for three to five days during a normal emissions period. They would like to collect data for about 3 periods, then select the best episode to complete the data/filter analysis.

2. Procedure

a. The Met Dept will provide a short prognosis paragraph describing the meteorological forecast for the three-day and seven-day time frames to the AMC and DAQ contact list each Monday and Thursday.

b. The AMC and DAQ will review the University's prognosis to see if the long-range forecast indicates the potential for a PM10 episode.

c. The AMC and DAQ will review the University's next prognosis to see if the short-range forecast remains on track for a PM10 episode.

d. The AMC and DAQ will discuss a positive short-range forecast, and in conjunction with other criteria important for a PM10 episode will call a go or no-go to setup for data collection.

e. Generally, the criteria will be interpreted loosely for the first episode then with increasing stringency as additional episodes are called (approximately three total).

3. Contact List

DAQ		
Brock LeBaron	487-0970 H 536-4006 W	blebaron@deq.state.ut.us
Patrick Barickman	536-4008 W	pbarickman@deq.state.ut.us
Jennifer Eden	536-4136 W	jeden@deq.state.ut.us
Carol Nielsen	536-4073 W	cnielsen@deq.state.ut.us
AMC		
Bob Dalley	254-1349 H 887-0762 W	rdalley@deq.state.ut.us
Neal Olsen	887-0764 W	rolsen@deq.state.ut.us
Kent Bott	887-0774 W	kbott@deq.stae.ut.us
Rolf Doebbeling	887-0760 W	rdoebbel@deq.stae.ut.us
Met Department		
Jim Steenburgh	581-8727	jimsteen@atmos.met.utah.edu
Daryl Onton	585-1409	djonton@atmos.met.utath.edu
Utah Mesonet Web Site		http://www.met.utah.edu/
Contractor		
Lyle Chinkin	707/665-9900	lyle@sonomatech.com
Neil Wheeler	707/665-9900	neil@sonomatech.com
Fred Lurman	707/665-9900	fred@sonomatech.com

E. Ambient Monitoring

1. Length of study

a. Depending on specific meteorological conditions, data collection will begin in December and end sometime in early March.

2. Rationale for selecting study sites

a. Additional data will be collected at sites that have historically measured high PM concentrations.

3. Parameters to be measured

a. The following pollutants need to be collected to verify model performance (include spatial, temporal and chemical reaction rate accuracy): PM, O3, NOx, SO2, NH4, WD, WS, Temp, RH and atmospheric stability.

4. Sampling schedule and averaging times for each parameter (see PM study chart)

a. All parameters will be collected for the duration of an air stagnation period. PM and speciated PM, with the exception of real-time PM, will be collected from midnight to midnight with some samples in four-hour intervals. Real time PM10, gaseous and meteorological parameters will be collected as hourly averages.

b. The PM10 study will be conducted on days when the meteorology is conducive to the accumulation of particulate matter in the lower levels of the atmosphere.

c. PM10 samples will be collected daily at Cottonwood, Hawthorne, Lindon, North Salt Lake and West Valley. PM10 samples will be collected every third day at the Logan, Magna and North Provo stations. In addition, PM2.5 samples will be collected daily at Hawthorne and Lindon and every third day at Bountiful, Cottonwood, North Provo, North Salt Lake, Ogden, Washington Terrace and West Valley. These filters will all be collected midnight to midnight to give a 24-hour average of particulate concentrations. The filters will be collected to determine mass concentrations of particulate matter. To determine particulate concentrations for shorter periods during the day, two sequential PM2.5 samplers are being converted to collect PM10 samples over four-hour periods at Hawthorne and Lindon. All the filters will be available so chemical analysis can be performed on the filters to determine the chemical content of the particulate matter collected. A PM2.5 “speciation” sampler will be operated at the Hawthorne station. This sampler will allow a wider range of chemical analysis of particulate matter than the other samplers.

d. Analyzers that measure PM10 continuously and provide hourly average information will be operated at the Hawthorne, Lindon and Ogden sites. The same type of continuous analyzers that measure PM2.5 will be operated at the Hawthorne and Lindon sites. Data from these analyzers will allow the evaluation of hourly changes in particulate concentrations.

e. Hourly data of gaseous nitrogen dioxide (NO2) and total nitrogen oxides (NOx) primarily nitric oxide (NO) will be collected at Bountiful, Cottonwood, Hawthorne, North Provo and Ogden. Hourly Ozone (O3) will be collected at the Beach and West Valley sites.

f. Daily PM2.5 speciaton samples will be collected at Hawthorne and analyzed as the availability of resources will allow.

g. Understanding and evaluating the meteorology during the periods that result in elevated particulate concentrations is very important; therefore, wind speed, direction and sigma will be collected at 21 sites during the study. Solar radiation will be collected at five sites.

h. Understanding the three-dimensional aspect of the atmosphere is also essential. Synoptic wind flow pattern will be obtained from the National Weather Service (NWS) at the Salt Lake Airport. A tetersonde balloon will be released into the atmosphere each

morning and afternoon to measure upper air movment over the Salt Lake Valley. In addition, the University of Utah will verify the readings by comparing them to an MM5 prognostic model.

i. In mid-January a Doppler acoustic sounder or SODAR will be operated during the study period. The SODAR will be located near a central valley location in Salt Lake Valley.

The attached "PM10 Study Chart" provides a convenient summary of the air monitoring that will be performed during the study period.

PM 10 STUDY CHART												
	PM10	PM2.5	Cont PM10	Cont PM2.5	NOX	NO2	O3	PM2.5 Spec	Wind Speed Direction	Temp/ RH	SR/BP	SG/DT/PRE
Antelope Is.									X	BOTH		SIGMA
Badger Is.									X	BOTH	SOLAR	SIGMA
Beach							X		X	TEMP		SIGMA
Bountiful		THIRD DAY			X	X			X	TEMP		SIGMA
Cottonwood	DAILY	THIRD DAY			X	X			X	BOTH		SIGMA
Grantsville									X	BOTH		SIGMA
Hawthorne	DAILY	DAILY	X	X	X	X		DAILY	X	BOTH	BOTH	
Herriman									X	BOTH	SOLAR	DT
Highland									X	TEMP		SIGMA
Lindon	DAILY	DAILY	X	X					X	BOTH		SIGMA
Logan	THIRD DAY								X	TEMP		
Magna	THIRD DAY								X	TEMP		SIGMA
North Ogden									X	TEMP		SIGMA
North Provo	THIRD DAY	THIRD DAY			X	X			X	TEMP		SIGMA
N. Salt Lake	DAILY	THIRD DAY								NONE		
Ogden	DAILY	THIRD DAY	X		X	X				NONE		
Promontory									X	BOTH		SIGMA
Saltaire									X	BOTH	SOLAR	SIGMA
Spanish Fork									X			SIGMA
Syracuse									X	BOTH	SOLAR	SIGMA
Wash. Terr.		THIRD DAY							X	BOTH		SIGMA
West Valley	DAILY	THIRD DAY					X		X	TEMP		
West Jordan									X	BOTH		

Gaseous data are reported as hourly averages; PM10/PM2.5 data are reported as 24-hr. averages (midnight-midnight)
Lindon and Hawthorne combined PM10 data are reported as 4-hour averages (midnight-midnight)

F. Description of Study Environment

All data will be collected at sites being part of the regulatory monitoring network, except for the Doppler acoustic sounder which will be located at a sewage treatment plant in Central Salt Lake County. Information about the other sites can be found in the site files located at the AMC. Doppler location information will become available as soon as the location is finalized.

G. Equipment Placement

Equipment placement will conform to requirements contained in 40 CFR, part 58, and On-site Meteorological Program Guidance for Regulatory Modeling Applications, EPA-450/4-87-013. June 1987.

H. Equipment Description

All monitoring and filter weighing room equipment used for the study are described in the AMC Quality Assurance Project Plan (QAPP) and the manufacturers users manuals including data acquisition systems.

I. Laboratory Analysis of Samples

Chemical speciation for the PM samples will be performed by ChesterLabNet a nationally recognized contract laboratory located in Tigard, Oregon.

The compounds that will be analyzed for are: Elements, metals, carbons, nitrates, sulfates and ammonium.

Chemical analysis of samples collected with the EPA speciation sampler located at Hawthorne site will also be performed by ChesterLabNet with the exception of nitrate and ammonium. These two compounds will be analyzed by the State of Utah Health Laboratory.

Both laboratories have their own internal SOPs, QC and QA procedures to determine the precision and accuracy of the analytical process according to nationally accepted methods. Written procedures will be provided upon request.

J. Quality Control Description

Since the data will be collected under the umbrella of the regulatory monitoring network, all quality control measures such as calibrations, zero/span checks, instrument maintenance, etc. for data collection will also apply to the PM study. The speciation sampler at Hawthorne is part of an EPA sponsored pilot study and field procedures for this study have not yet been finalized.

K. Quality Assurance Description

As under **Quality Control** above, all quality assurance for the study such as performance audits, precision checks, traceability of standards, calculations for precision, accuracy, data reduction, validation and data recovery, etc. will be done under the procedures written for the regulatory monitoring network. National Weather Service data will be accepted without quality assurance documentation as allowed by a long standing EPA policy.

L. Data Chain of Custody

All samples collected by the AMC will be under the custody of the AMC staff and handeled according to AMC custody procedures. Samples sent to analytical laboratories will be accompanied by data chain of custody sheets and appropriate signatures will be required at sample transfer points. These sheets will be part of the study records.

M. Final Report

No final report will be prepared for the special monitoring study; however, all quality control and quality assurance records will be made available to the DAQ Technical Analysis Section. These records will provide technical support documentation for the final UAM-AERO modeling results.